

Research in progress on The Superior National Forest: large scale disturbance and climate change

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With: Peter B. Reich, Terry Serres, Eli Anozzko, Dave Chaffin

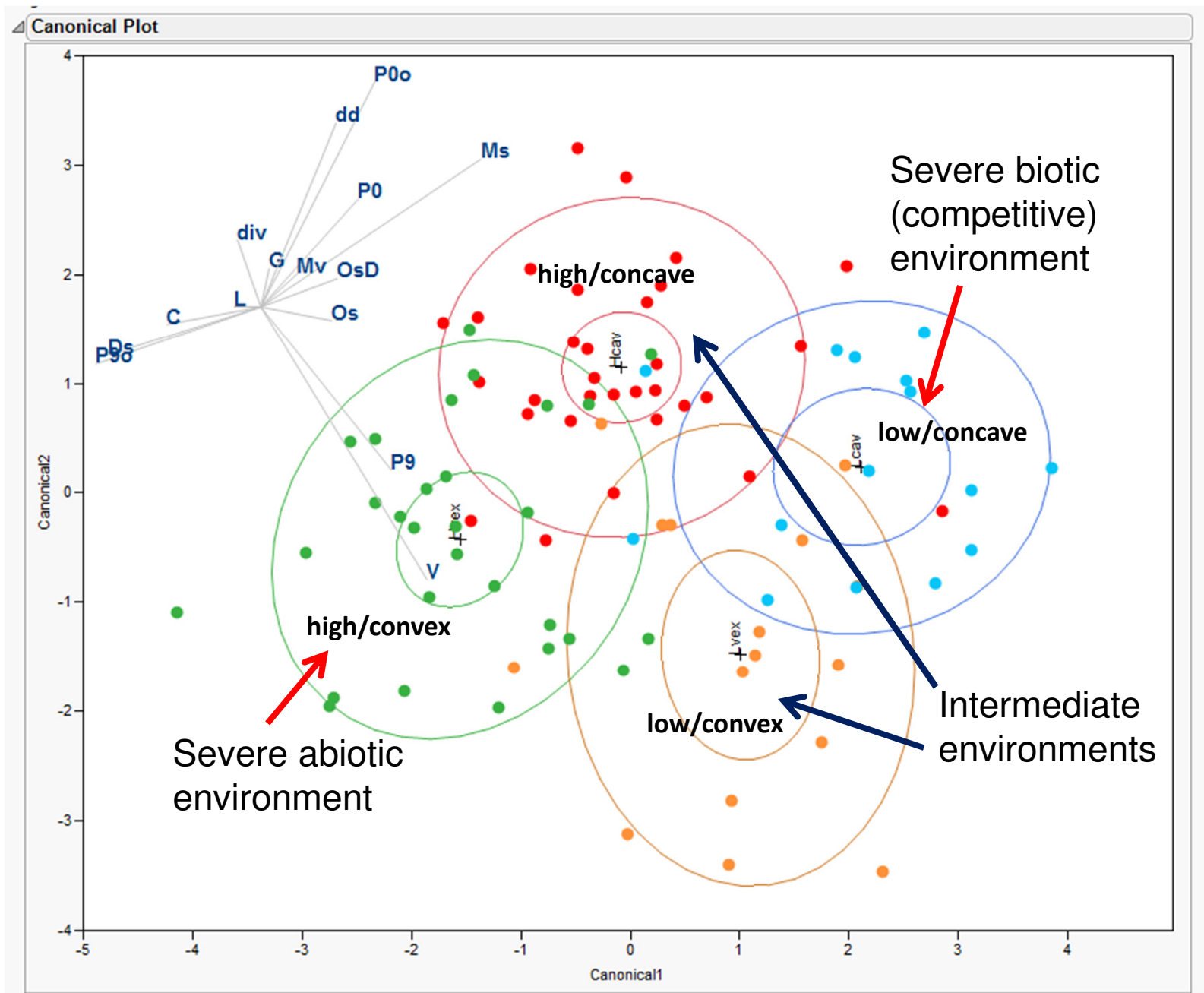
Part I, Terry Serres

Fire and compound disturbance effects on pine seedling germination, seedling dispersion, and post fire composition

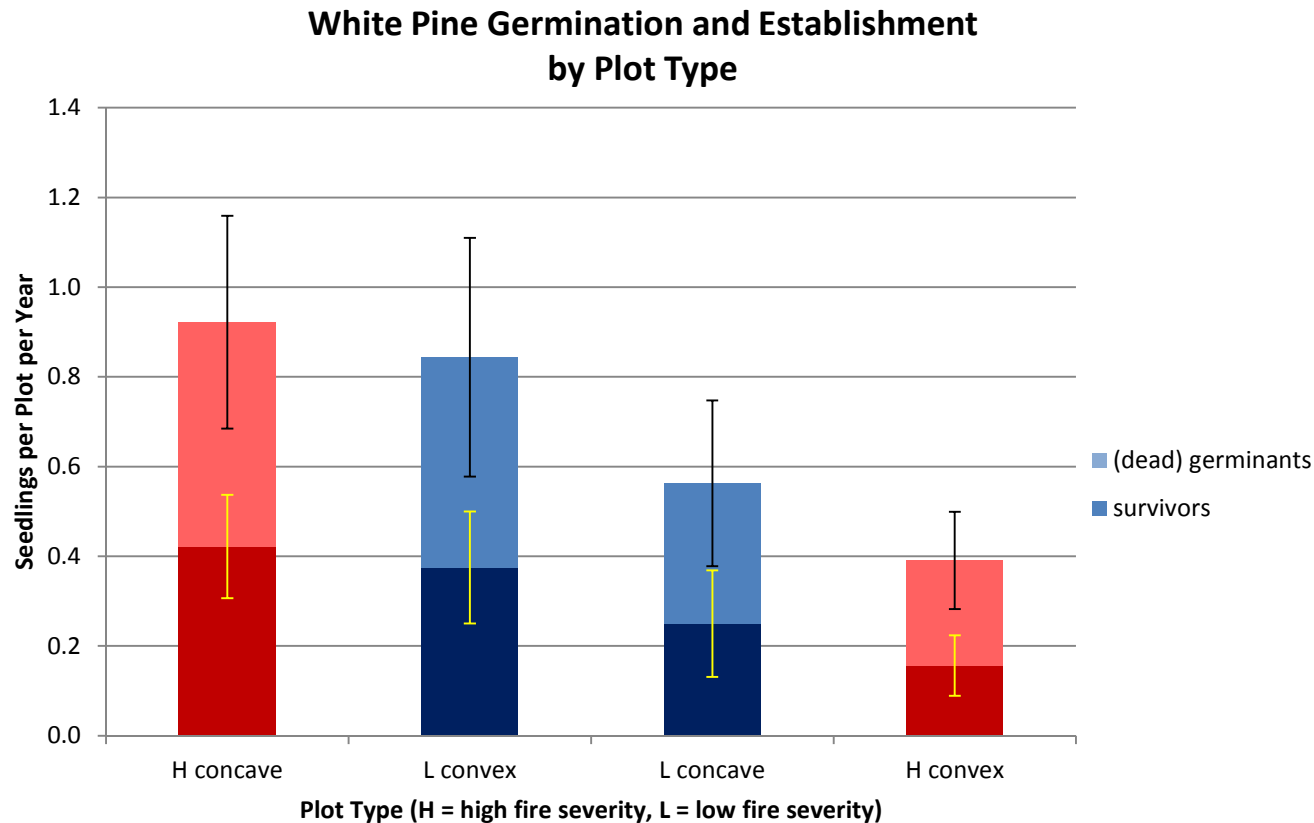


How does complex microtopography affect seedling germination and success?





Effects of Fire Severity and Microtopography on Germination and Establishment of White Pine

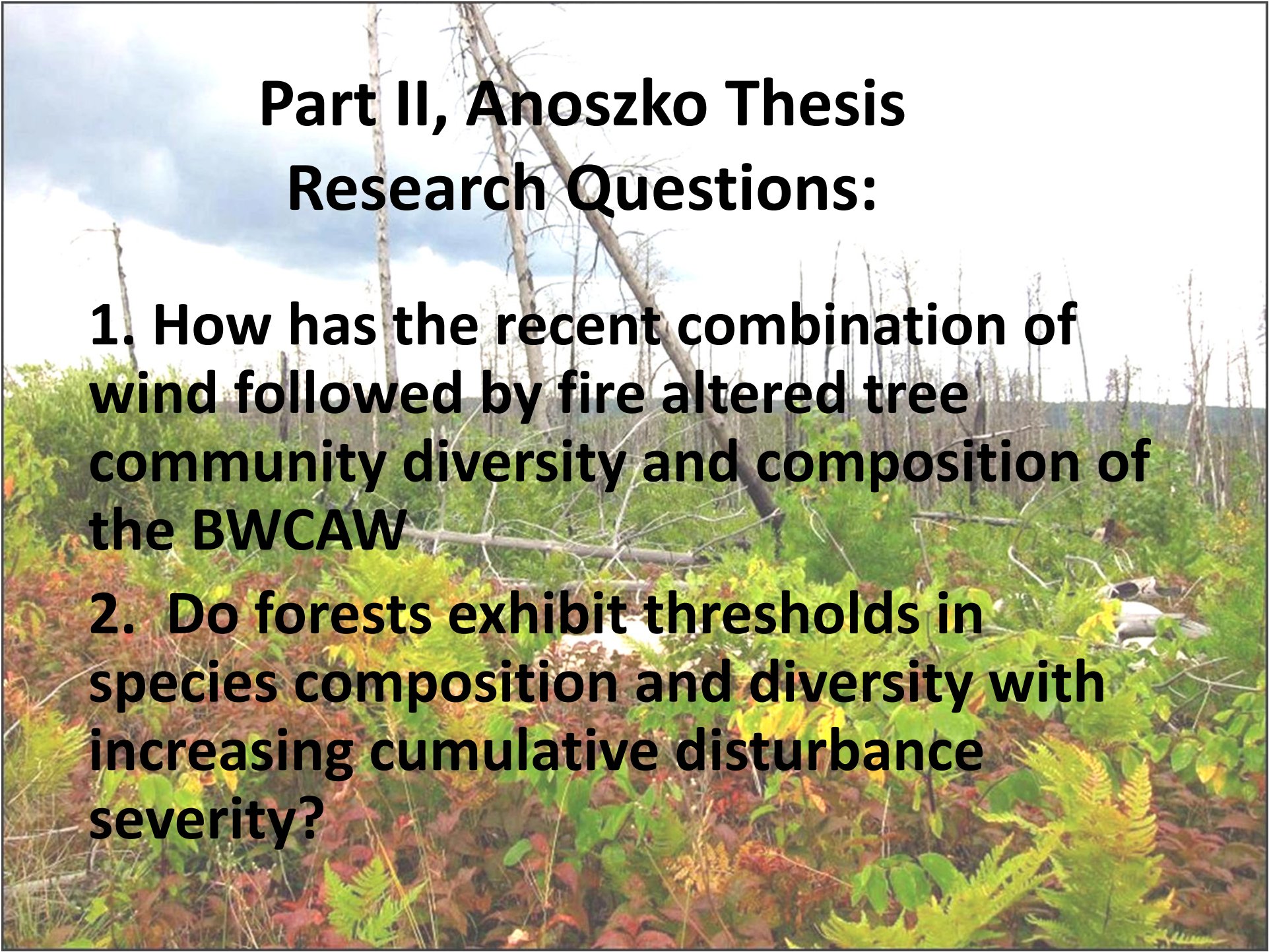


The intermediate environments favor germination and establishment; Similar trend for red pine. Seedling Biomass was also higher in high severity plots and concave plots.



Still working:

- Effects of fuel consumption/fire intensity on composition of regeneration (450 plots in prescribed burn in blowdown on Threemile Island)
- Dispersion of red and white pine seedlings relative to surviving mature trees on Miles and TMI



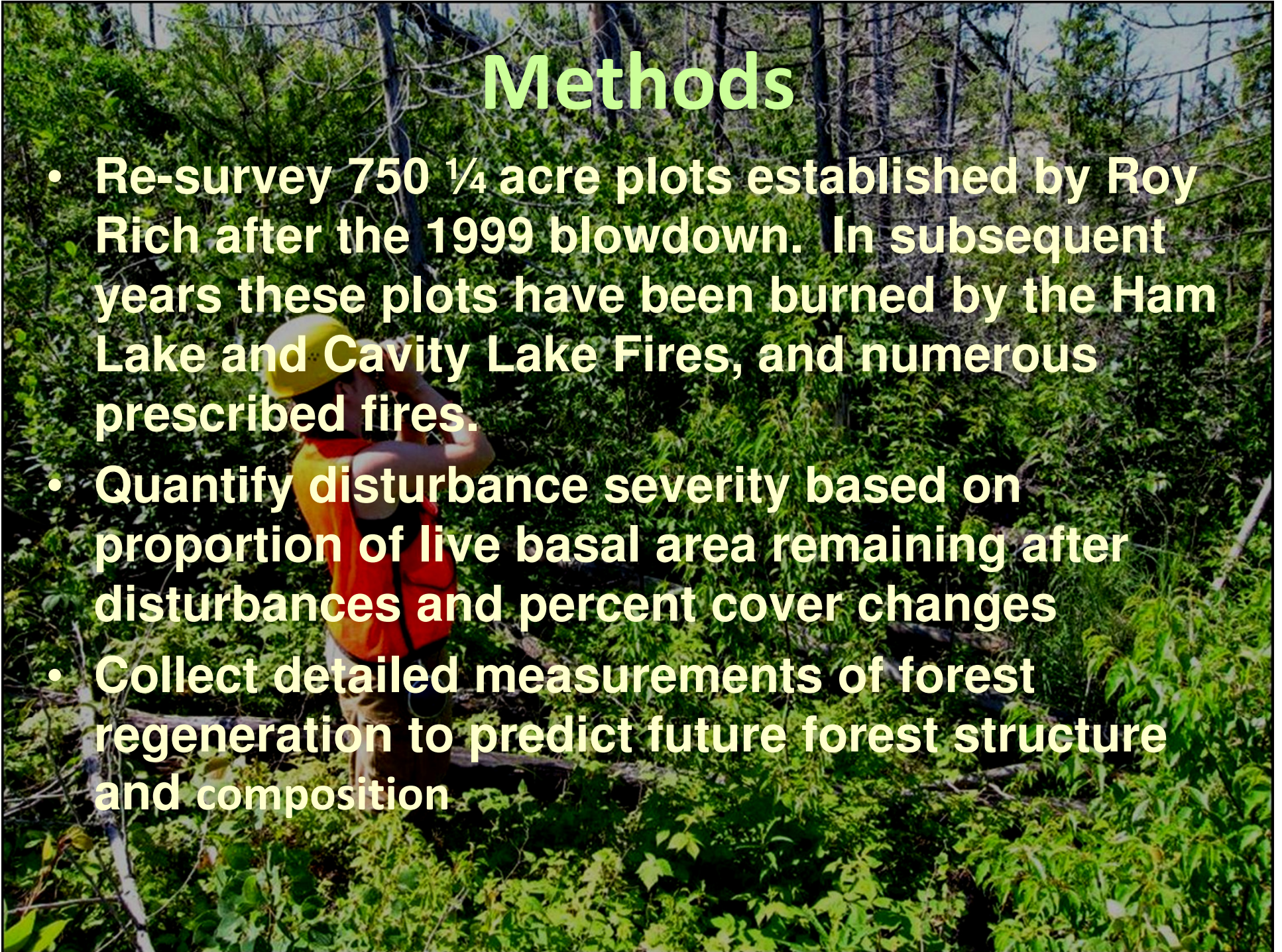
Part II, Anoszko Thesis Research Questions:

1. How has the recent combination of wind followed by fire altered tree community diversity and composition of the BWCAW

2. Do forests exhibit thresholds in species composition and diversity with increasing cumulative disturbance severity?

Methods

- Re-survey 750 $\frac{1}{4}$ acre plots established by Roy Rich after the 1999 blowdown. In subsequent years these plots have been burned by the Ham Lake and Cavity Lake Fires, and numerous prescribed fires.
- Quantify disturbance severity based on proportion of live basal area remaining after disturbances and percent cover changes
- Collect detailed measurements of forest regeneration to predict future forest structure and composition



Preliminary Results-Blowdown only

- The 1999 windstorm caused high mortality among early-successional species such as jack pine and aspen
- In the absence of fire, these stands have continued to shift towards late-successional species
- Regeneration is dominated by advanced regeneration of shade tolerant species (balsam fir, white cedar, black spruce, mountain maple)

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Preliminary Results- Blowdown+Fire

- Combination of wind and fire has been very severe; near 100% mortality in all plots.
- Regeneration is dominated by species with seed banks, long distance seed dispersal or vegetative regeneration (aspen, birch, pin cherry, beaked hazel).
- Very little conifer regeneration, except along lakeshores where surviving seed sources are present.
- Jack pine locally abundant in some prescribed burns, but overall greatly reduced in abundance.

Diverging Succession?

Pre-disturbance composition

Wind

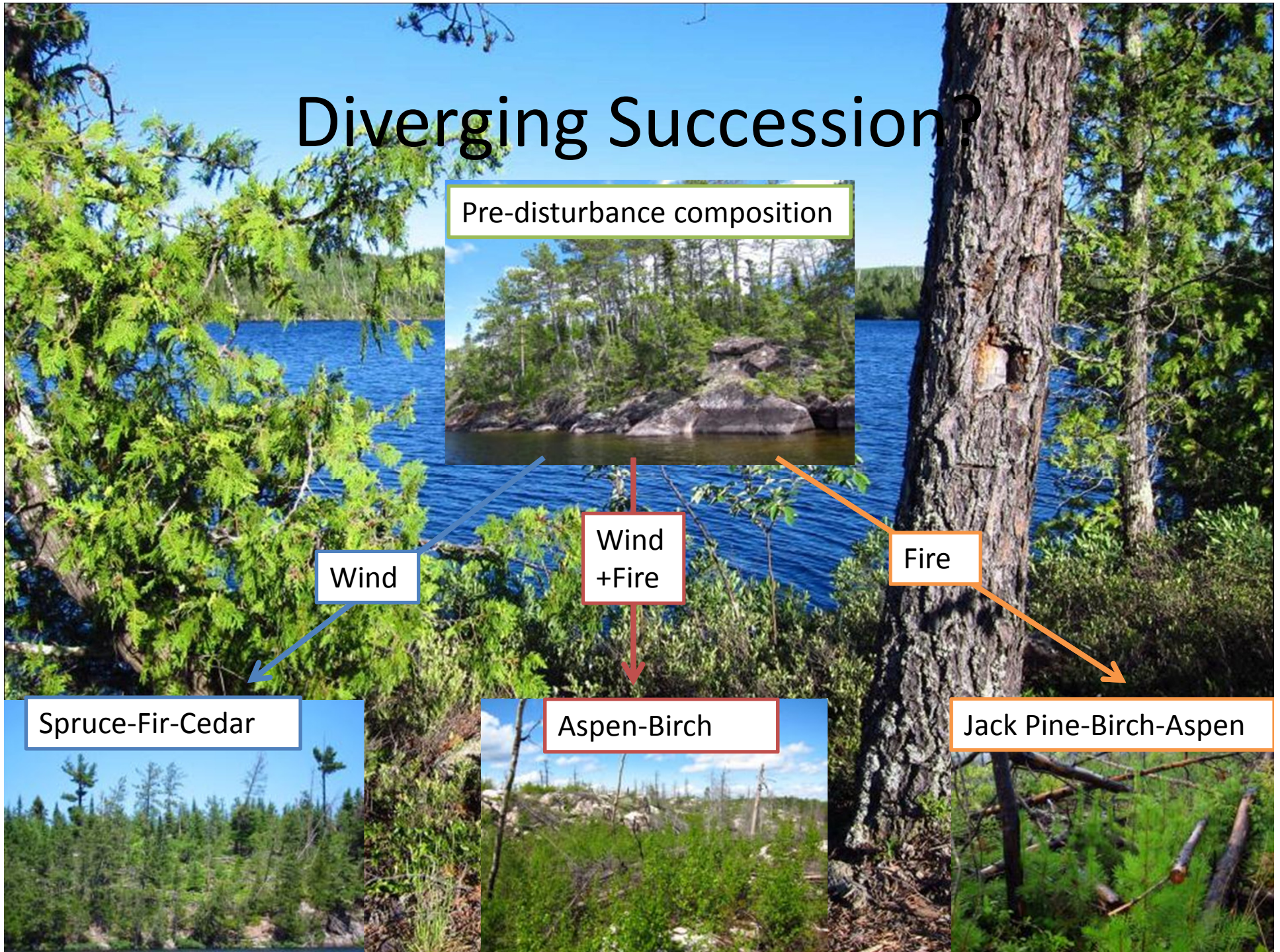
Wind
+Fire

Fire

Spruce-Fir-Cedar

Aspen-Birch

Jack Pine-Birch-Aspen



Part III, David Chaffin:

Climate change and resilience in MN's southern boreal forest
Hypotheses and questions

Climate warming will contribute to a major shift in forest composition at the boreal-temperate forest interface within the BLES.

Temperate tree and invasive plant species will expand their northern ranges at the expense of boreal tree species, which will contract their southern ranges.

Remnant populations of boreal species may persist within local temperature refugia.

Are sufficient seed source populations of temperate tree species currently present in the BLES for the forest to transition from a boreal to temperate dominated system under climate warming?

Are sufficient seed source populations of invasive plant species currently present in the BLES for those species to potentially impede such a transition?

Do relief-driven cold refugia exist on the landscape, such as north facing slopes, where boreal species might persist under a future warmer climate?

Project Team

- Dr. Lee Frelich, PI
- Dr. Peter Reich, Collaborator
- Dr. Rebecca Montgomery, Collaborator
- David Chaffin, PhD Student

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On Minnesota Resources (LCCMR, ENRTF)

Study Activities

Are sufficient seed source populations of temperate tree species currently present in the BLES for the forest to transition from a boreal to temperate dominated system under climate warming?



Survey large tracts of forest to assess abundance and distribution of temperate tree species

Are sufficient seed source populations of invasive plant species currently present in the BLES for those species to potentially impede such a transition?



Survey large tracts of forest to assess abundance and distribution of invasive plant species

Do relief-driven cold refugia exist on the landscape, such as north facing slopes, where boreal species might persist under a future warmer climate?



Install network of 100 temperature sensors across landscape to locate potential cold-temperature refugia

Outcomes

- Models/maps by temperature and landform:
 1. Temperate tree species distribution within the BLES
 2. Invasive plant species and earthworm distribution within the BLES
 3. Potential cold-temperature refugia for boreal tree species
- Outreach and education on forest adaptation options